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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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09/160,965

09/25/98

SHUE

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TSMC97-542/9

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EXAMINER

KIELIN, E

ART UNIT

PAPER NUMBER

2813

DATE MAILED:

04/05/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademark

Office Action Summary

Application No.
09/160,965

Applicant(s)
Shue et al.

Examiner
Erik Kielin

Group Art Unit
2813



☒ Responsive to communication(s) filed on Feb 26, 2001

☒ This action is **FINAL**.

☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire 3 month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claims

☒ Claim(s) 1, 2, 4, 6, and 10-12 is/are pending in the application.

Of the above, claim(s) _____ is/are withdrawn from consideration.

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) 1, 2, 4, 6, and 10-12 is/are rejected.

☐ Claim(s) _____ is/are objected to.

☐ Claims _____ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been
☐ received.

☐ received in Application No. (Series Code/Serial Number) _____.

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☐ Notice of References Cited, PTO-892

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). _____

☐ Interview Summary, PTO-413

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

--- SEE OFFICE ACTION ON THE FOLLOWING PAGES ---

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DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-2, and 4, 6, 10-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Lin** (US 6,093,656) in view of **Datta et al.** (US 5,567,300)

Lin discloses the silicon substrate 12, the damascene trenches 13, 14 in a dielectric layer, the barrier metal layer (column 3, lines 17-23); the copper layer 20 (or “conductor,” claim 1); the reverse tone photoresist mask 26 which covers the copper in the trenches (column 3, lines 32-57; Fig. 3); etching the exposed copper portions down to the silicon using a wet etch (Fig. 4; column 4, lines 15-21); stripping the photoresist (column 4, lines 22-25); planarizing the copper by CMP (column 4, lines 27-29). See also columns 1-4 and all figures.

Lin does not (1) specifically use the terminology, “dual damascene” or show a dual damascene structure in the figures. **Lin** does not teach (2) the seed layer or electroplating; or (3) reverse current electroplating.

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Regarding (1), aside from it being known in the art that *dual* damascene (as opposed to *single* damascene) is also subject to dishing during metal planarization and for the same reasons (see for example, **Fiordalice** et al., US 5,578,523, column 1, line 59 to column 2, line 27), Lin's claim 1 indicates the damascene, dielectric trenches have "at least two levels of elevation." A third level of elevation would clearly yield a dual damascene trench structure. Therefore, Lin implicitly defines the invention for dual damascene. Note that it has been held that "[I]n considering the disclosure of a reference, it is proper to take into account not only specific teachings of the reference but also the inferences which one skilled in the art would reasonably be expected to draw therefrom." *In re Preda*, 401 F.2d 825, 826, 159 USPQ 342, 344 (CCPA 1968) See also *In re Lamberti*, 545 F.2d 747, 750, 192 USPQ 278, 280 (CCPA 1976). Therefore, dual damascene is at least implicitly disclosed as being incorporated both in Lin's inclusive claim language and in that fact that dual damascene is notoriously well known in the art, especially as defined in the Lin claims.

Regarding (2) Examiner gives Official Notice that seed layers and electroplating to deposit copper or other metal layers are notoriously well known in the art, the gross details of which can be found in the ASM Handbook on Surface Engineering, Vol. 5. Such information will be provided upon Applicant's request. Furthermore, Lin teaches that the blanket deposition of copper "could be done in a number of different ways..." (column 3, lines 23-27). Consequently, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use any conventional copper deposition method for the reason given in Lin.

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Regarding (3), **Datta** et al. and references cited therein teach the benefits of reverse current electroplating for the purpose of removing unwanted metal -- particularly copper -- regions for the purpose of planarizing (sections entitled "Planarization is desirable for two reasons" and "There are various planarization methods").

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Lin in view of Datta for the reasons given in Datta.

Lin does not teach the capping layer. Examiner gave Official Notice that it was well known to use capping layers over copper in the previous Office Action , Paper No.9, filed 10/3/00. Because Applicant has not timely challenged the validity of the capping layer, it must be assumed that Applicant agrees that this is known to those of skill in the art. Furthermore, Applicant has not shown in the disclosure how the use of a capping layer *after* planarization has anything to do with the main objective of the instant invention: planarization of copper damascene. Absent evidence to the contrary, the presence or absence of the capping layer would not affect the results of those steps occurring *before* the addition of such a layer.

Regarding claim 4, in claim 1 of **Lin**, the layer 20 is limited to only "conductors" and therefore makes the use of any of Applicant's claimed conductors obvious. It has been held that selection of a known material based on its suitability for its intended use is *prima facie* obvious. Regarding claim 6, **Lin** does not indicate that the dielectric is silicon oxide, but it is known to use silicon oxide for the dielectric in damascene processes and is therefore obvious to one of ordinary skill to use as a matter of routine material choice. See *Sinclair & Carroll Co., Inc. v.*

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Interchemical Corp., 325 U.S. 327, 65 USPQ 297 1945). See also *In re LESHIN*, 125 USPQ 416 (CCPA 1960). The choice of silicon oxide for Lin's dielectric; Au, Al, with, Ti, or Ag for Lin's conductor; and are obvious as amounting obvious material choice, well within the purview of those of ordinary skill, as per the precedent above.

Regarding claims 11-12, Lin makes clear the inherency or alternatively suggests Applicant's "critical dimensions" in Lin's discussion of the reverse tone photoresist mask. It's use is obvious as a matter of routine optimization. These claims are *prima facie* obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. In *re* Woodruff, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See *In re Aller*, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art general conditions is obvious).

Response to Arguments

3. Applicant's arguments filed 2/26/01 have been fully considered but they are not persuasive.

Regarding the rejection over **Lin** and in view of **Datta**, Applicant appears to argue that Examiner cannot argue the limitations not specifically disclosed separately, while agreeing that the points made are each valid. Applicant then argues that the inventions are somehow not related. Examiner respectfully disagrees. The relevant point to be considered under 35 USC 103(a) is whether or not one of ordinary skill in the art would combine the references cited based upon the suggestion provided therein to arrive at the instant invention. This is the case for each point, hence the combination is proper. Particularly in this regard, given that one of ordinary skill in the

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metal deposition art knows very well dual damascene, electroplating, and reverse current electroplating for planarization of the metal --all of which are used together-- there is nothing new in the combination merely because separate references were provided for each of the limitations.

Applicant also argues that the combination of the references is improper, but has not provided a reason why one of ordinary skill would not combine them, relying instead upon unclaimed features of the invention. Examiner cannot rebut the arguments further since Applicant has, furthermore, agreed that Examiner's arguments regarding the combination were proper.

Conclusion

4. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

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5. Any inquiry concerning this communication from examiner should be directed to Erik Kielin whose telephone number is (703) 306-5980 and e-mail address is erik.kielin@uspto.gov. The examiner can normally be reached by telephone on Monday through Thursday 9:00 AM until 7:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Charles Bowers, can be reached at (703) 308-2417 or by e-mail at charles.bowers@uspto.gov. The fax phone number for the group is (703) 308-7722 or -7724.

EK
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April 4, 2001